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(54) Title: ATTACHMENT FOR USE WITH STOCKPILING BARGE AND METHOD OF FILTERING RUNOFF WATER THEREFROM

(57) Abstract: An attachment to a drainage hose for use on a stockpiling barge that includes: a fluid pervious bag formed of a flexible fabric material, the fluid pervious bag having an open end and a closed end, a ballast material attached to or retained within the closed end of the fluid pervious bag, and means for securing the open end of the fluid pervious bag about a hose. Also disclosed are the attachment in combination with a drainage hose and a stockpiling barge, a method of filtering runoff water from a stockpiling barge through the use of the attachments, and a method of preventing non-dissolved organic or inorganic contaminants from flowing from a stockpiling barge into a body of water through the use of the attachments.

ATTACHMENT FOR USE WITH STOCKPILING BARGE AND METHOD OF FILTERING RUNOFF WATER THEREFROM

[001] The present application is entitled to the priority benefit of U.S. Provisional Patent Application Serial No. 60/354,107 filed February 4, 2002, which is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

[002] The present invention relates generally to water filtration systems designed for use in aquatic environments, particularly for use in dredging operations to filter runoff water entering the aquatic environment from a stockpiling barge.

BACKGROUND OF THE INVENTION

[003] Dredging operations are routinely carried out in many water ways where access to a port site is desired. The dredging allows for removal of sedimentation from within a body of water such that the depth of the water column is sufficient for ingress and egress of vessels. However, dredging operations can cause significant harm to the aquatic environment, particularly where sediment is known to be contaminated with heavy metals such as mercury or organic contaminants such as polychlorinated biphenyls.

[004] Resuspension of sediment, whether contaminated or not, into the water column and surrounding environment is always a concern for dredging operations. Resuspension can occur during two phases of the dredging operation, either from the removal activity or from the runoff of water from the stockpiling barge. To minimize the effect of resuspension during the removal activity, the dredging site can be surrounded by aquatic barriers of the type disclosed in U.S. Patent No. 5,102,261 to Gunderson III or U.S. Patent No. 6,485,229 to Gunderson III, et al. However, this typically is insufficient for the stockpiling barges, which must be moved to and from the dredging site and, therefore, cannot easily be contained by such barriers.

[005] Stockpiling barges must release excess water during dredging. This is achieved via drainage holes spaced about the perimeter of the barge, typically at the

communication to a corresponding drainage outlet and a second end, and one or more attachments according to the first aspect of the present invention, with each of the attachments being secured to a corresponding drainage hose by the means for securing, with the second end of the drainage hose positioned internally of the fluid pervious bag; and introducing dredged materials into the stockpiling barge, wherein water and sedimentation flowing from the stockpiling barge through the one or more drainage outlets passes into the corresponding attachment, whereby sedimentation flowing through the drainage outlet is retained within the corresponding attachment while water passes freely through the flexible material that forms the fluid pervious bag.

[011] A fifth aspect of the present invention relates to a method of preventing non-dissolved organic or inorganic contaminants from flowing from a stockpiling barge into a body of water. This method includes: performing the method according to the fourth aspect of the present invention, wherein the dredged materials further contain non-dissolved organic or inorganic contaminants, whereby non-dissolved organic or inorganic contaminants flowing through the drainage outlet are retained within the corresponding attachment while water passes freely through the flexible material that forms the fluid pervious bag.

[012] Because the fluid pervious bag allows for capture of sediment particles that are larger than the pores of the flexible fabric material, a large portion of sediment that normally would flow back into the aquatic environment surrounding a dredge site can be contained and removed. Not only does this minimize environmental harm at the site, particularly where contaminants are present in the sediments, but this also facilitates a substantial reduction in turbidity at the site. An approximately 10- to 100-fold reduction in turbidity caused by barge runoff can be achieved. The decrease in turbidity will allow for greater ease and efficiency in carrying out the dredging operation and, as a result, likely afford decreased dredging costs. Additional benefits include the potential removal or partial removal of hydrocarbons in the dredge spoils runoff via absorption into the flexible fabric material used to form the fluid pervious bag. Preferred oleophilic non-woven geotextiles, when used, and with the appropriate retention time, will absorb hydrocarbons.

[020] Preferred flexible fabric materials are geosynthetic fabrics. Geosynthetic fabrics are formed of polymeric materials and can be either woven or non-woven. The geosynthetic fabric is "water-pervious," meaning that water passes through the fabric and is not absorbed by the fabric.

[021] Typically, the geosynthetic fabric will also be "oleophilic," meaning that it absorbs or attracts oil (more generally, hydrocarbons), thereby blocking the flow of oil, but allows water to flow therethrough. For containment of silt and other suspended particulates, it is not essential that the fluid pervious bag be oleophilic. However, many pollutants are hydrocarbon-based and to contain those pollutants, the fluid pervious bag preferably is oleophilic.

[022] Useful geosynthetic fabrics are further characterized by high load distribution capacity, the ability to abate material filtration, and permeability to water. Geosynthetic fabrics are commercially available in a range of tensile strengths, permeabilities, and permitivities, and are useful for the purposes of the invention throughout those ranges.

[023] The geosynthetic fabrics are nonbiodegradable, so they do not deteriorate due to environmental exposure. During prolonged use, exposure to ultraviolet (UV) light may cause some geosynthetic fabrics to weaken or deteriorate. However, UV-resistant fabrics are commercially available as well as UV resistance treatment methods.

[024] Geosynthetic fabric may be prepared using one or a combination of various polymers, for example polyester, polypropylene, polyamides, and polyethylene. Most commercially available geosynthetic fabrics are polypropylene or polyester. Examples of suitable nonwoven geosynthetic fabrics include, but are not limited to, AMOPAVE® 4399, AMOPAVE® HD 4597, 4545, 4553, and 4561 (all polypropylene fabrics commercially available from Amoco Fabrics and Fibers Company); Typar®, a polypropylene fabric commercially available from Dupont; TREVIRA® Spunbond, a polyester fabric commercially available from Hoechst Fibers Industries. Examples of suitable woven geosynthetic fabrics include, but are not limited to, 1380 SILT STOP®, 1198, 1199, 2090, 2000, 2006 (all polypropylene fabrics commercially available from Amoco Fabrics and Fibers Company).

[025] The fluid pervious bag can be constructed from the flexible fabric material by simply preparing sewn, heat fused, or sonically welded seams along the

from flowing through the open end of the fluid pervious bag. That is, the open end should be secured about the drainage hose in a manner whereby substantially all fluid entering the fluid pervious bag from the drainage hose will exit the fluid pervious bag through its flexible fabric material rather than the open end (when secured to the drainage hose).

[030] The attachments may further include one or more straps connected to the fluid pervious bag adjacent to the open end thereof. The one or more straps are intended to be coupled to support wires that will take any load off of the connections between the drainage hose and the drainage holes (on the barge) and between the drainage hose and the attachment. The one or more straps are preferably nylon straps of sufficient dimension and durability to accommodate the loads applied thereto. Connection between the straps and the flexible fabric material used to form the fluid pervious bag is preferably made by stitching, although other forms of connection, such as heat fusion or sonic welding can be utilized.

[031] Referring now to Figures 1 and 2, an attachment 10 according to a first embodiment of the present invention is illustrated. The attachment 10 includes a fluid pervious bag 12 that is formed of a geosynthetic material of the type described above. The bag 12 is constructed by folding a rectangular sheet onto itself and simply preparing a sewn seam 14 along one end 16 (forming the closed end) and the lengthwise side 18. At the open end 20, a channel 22 is formed by an annular sewn seam 24. Using either a single opening or, as shown, a pair of openings 26,26', a cord 28 is provided within channel 22 such that its ends extend respectively from the openings 26,26'. The attachment 10 also includes a ballast 30 (in the form of a length of chain) that is shown resting in the fluid pervious bag 12 at its closed end 16, and a pair of straps 32,32' that are connected to the geosynthetic material via a sewn connection.

[032] In use, shown in Figure 2, the attachment 10 is connected to the end of a drainage hose 40. With its open end 20 placed over the end of the drainage hose 40, such that the end of the drainage hose is positioned internally of the bag 12, the ends of the cord 28 are drawn around the drainage hose 40 so as to cinch the open end 20 tightly against the surface of the drainage hose. The end of the cord 28 can be tied together to maintain the connection between the bag 12 and the drainage hose 40.

sufficient constrictive force to prevent uncoupling of the bag/hose connection during use.

[037] Referring now to Figure 4, an attachment of the present invention, e.g., attachment 10, is shown installed on one end of a discharge hose 40 whose opposite end is connected to a drainage outlet 102 present at one corner of a stockpiling barge 100. Although only one corner of the stockpiling barge is illustrated, it should be appreciated that such a stockpiling barge will typically include two or more outlets and, more typically, four or more outlets (i.e., one at each corner of the barge). The stockpiling barge 100 is also equipped with cleats or rings 104 to which are attached the ends of cables 42,42'. The stockpiling barge 100 also includes a bulwark 106 about the perimeter of the barge to contain the dredged materials DM removed from the body of water. To prevent clogging of the drainage outlet 102, a framed filter 110 is provided at a position spaced from the outlet.

[038] The framed filter 110 includes a rigid frame 112 secured to the inner sides of the bulwark 106, a semi-rigid mesh screen 114 formed of, e.g., metal or thermoplastic materials, and a sheet 116 of fluid-pervious flexible fabric material of the type described above. The mesh screen 114 and the sheet of flexible fabric material 116 are contiguous over substantially the entire surface area of the filter 110. The screen 114 is shown positioned proximal to the outlet 102 and the sheet 116 positioned distal to the outlet 102, whereby the screen 114 effectively supports the sheet 116 against the forces applied by the mass of dredged materials DM. The geosynthetic fabric material that forms the sheet 116 preferably has an average pore size of about 100 to about 150 microns, which is usually sufficient to retain larger sediment while allowing fluids and fine sediment to pass therethrough.

[039] In use, a crane barge will remove dredge materials (including sediment and water) from the body of water and place the dredged materials DM onto the stockpiling barge 100, specifically within the region defined by the bulwark 106. As the dredged materials DM remain on the stockpiling barge 100, water and sediment will flow toward the drainage outlets 102. The flow will first pass through the framed filter 110, which allows only fluids and sediments finer that its pore size to pass therethrough. The modified flow of fluid and sediments continues through the respective drainage outlet 102 and into discharge hose 40, which carries the flow into the region internal of the fluid pervious bag 12. While most sediments are retained

What is Claimed:

1. An attachment to a drainage hose for use on a stockpiling barge, the attachment comprising:

a fluid pervious bag formed of a flexible fabric material, the fluid pervious bag having an open end and a closed end,

a ballast material attached to or retained within the closed end of the fluid pervious bag, and

means for securing the open end of the fluid pervious bag about a hose.

2. The attachment according to claim 1, wherein the flexible fabric material is a geosynthetic fabric.

3. The attachment according to claim 1, wherein the ballast material is attached to the closed end externally of the fluid pervious bag.

4. The attachment according to claim 1, wherein the ballast material is attached to the closed end internally of the fluid pervious bag.

5. The attachment according to claim 1, wherein the ballast material is retained within the fluid pervious bag.

6. The attachment according to claim 1, wherein the ballast material is in the form of a chain.

7. The attachment according to claim 1, wherein the fluid pervious bag includes a channel formed by the flexible fabric material about the open end, the channel including first and second openings.

8. The attachment according to claim 1, wherein the means for securing comprise a rope located with the channel, the rope including first and second ends which extend from, respectively, the first and second openings of the channel.

16. The combination according to claim 14, wherein the stockpiling barge further includes one or more filters positioned, respectively, between the portion of the stockpiling barge designed to receive dredged materials and the one or more outlets.

17. The combination according to claim 16, wherein the one or more filters each comprise a frame, a mesh screen secured to the frame, and a sheet of flexible fabric material secured to the frame, wherein the mesh screen and the sheet of flexible fabric material are contiguous over substantially the entire surface area of the filter.

18. A method of filtering water flowing from a stockpiling barge comprising:

providing a stockpiling barge that is designed to receive dredged materials and includes one or more drainage outlets, one or more drainage hoses each having a first end coupled in fluid communication to a corresponding drainage outlet and a second end, and one or more attachments according to claim 1 each secured to a corresponding drainage hose by the means for securing, with the second end of the drainage hose positioned internally of the fluid pervious bag; and

introducing dredged materials into the stockpiling barge, wherein water and sedimentation flowing from the stockpiling barge through the one or more drainage outlets passes into the corresponding attachment, whereby sedimentation flowing through the drainage outlet is retained within the corresponding attachment while water passes freely through the flexible material that forms the fluid pervious bag.

19. A method of preventing non-dissolved organic or inorganic contaminants from flowing from a stockpiling barge into a body of water comprising:

performing the method according to claim 18, wherein the dredged materials further contain non-dissolved organic or inorganic contaminants, whereby non-dissolved organic or inorganic contaminants flowing through the drainage outlet are retained within the corresponding attachment while water passes freely through the flexible material that forms the fluid pervious bag.

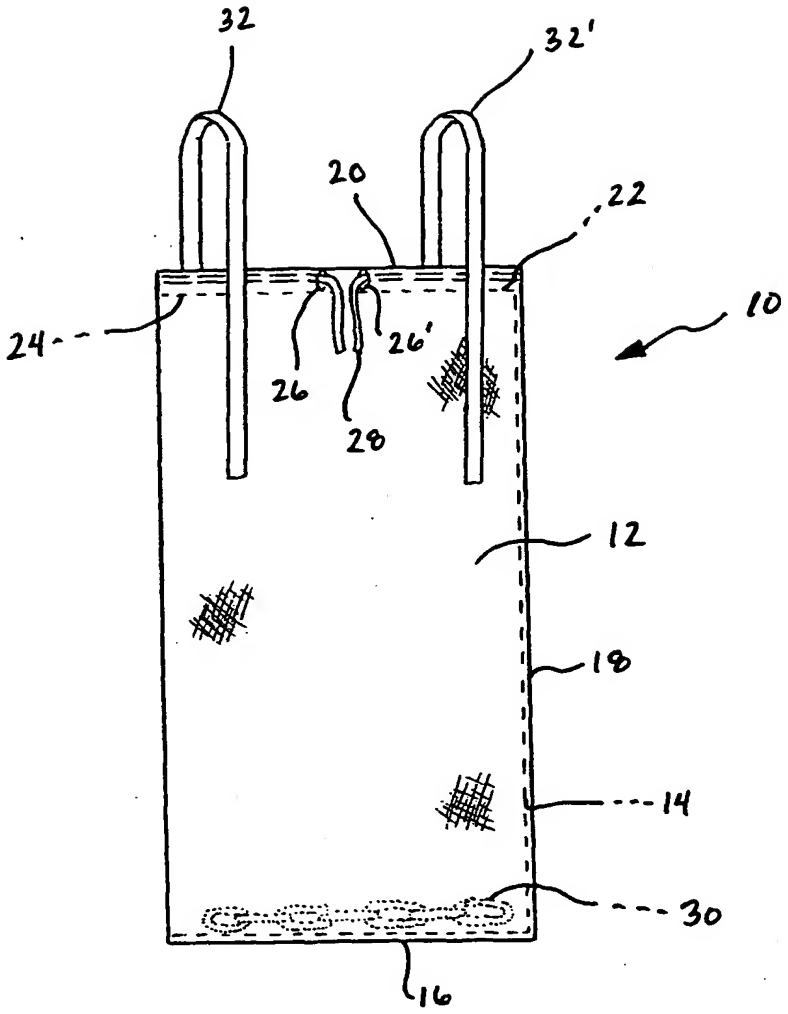


FIGURE 1

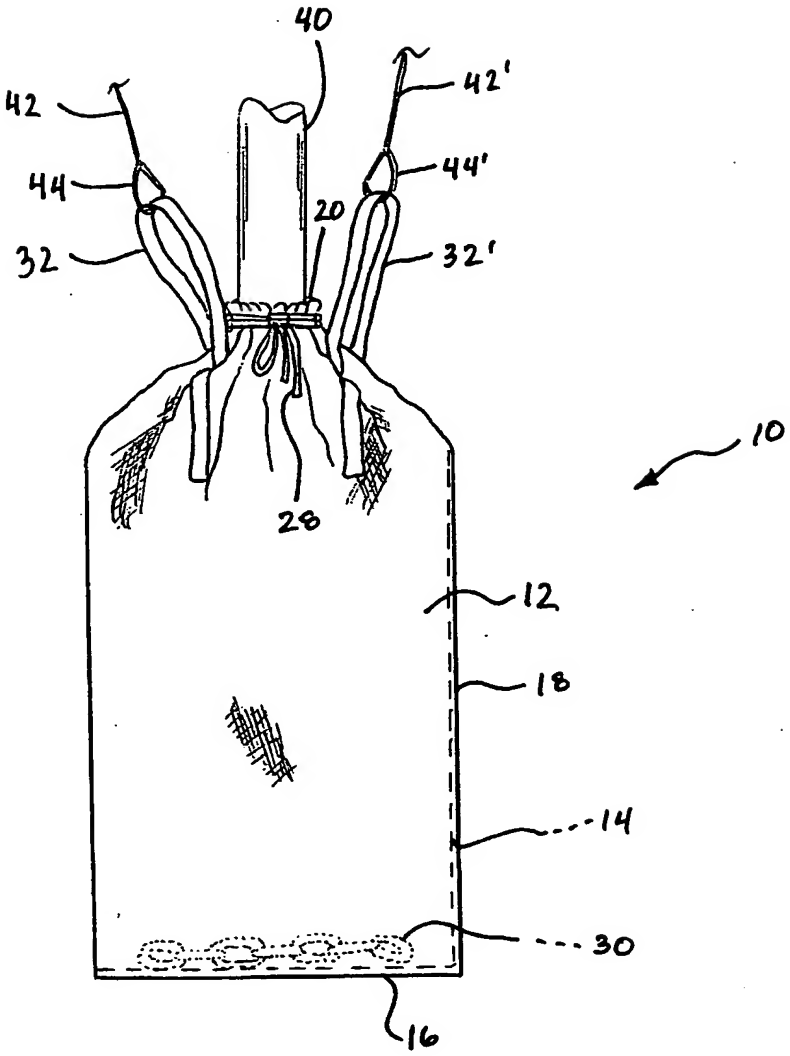


FIGURE 2

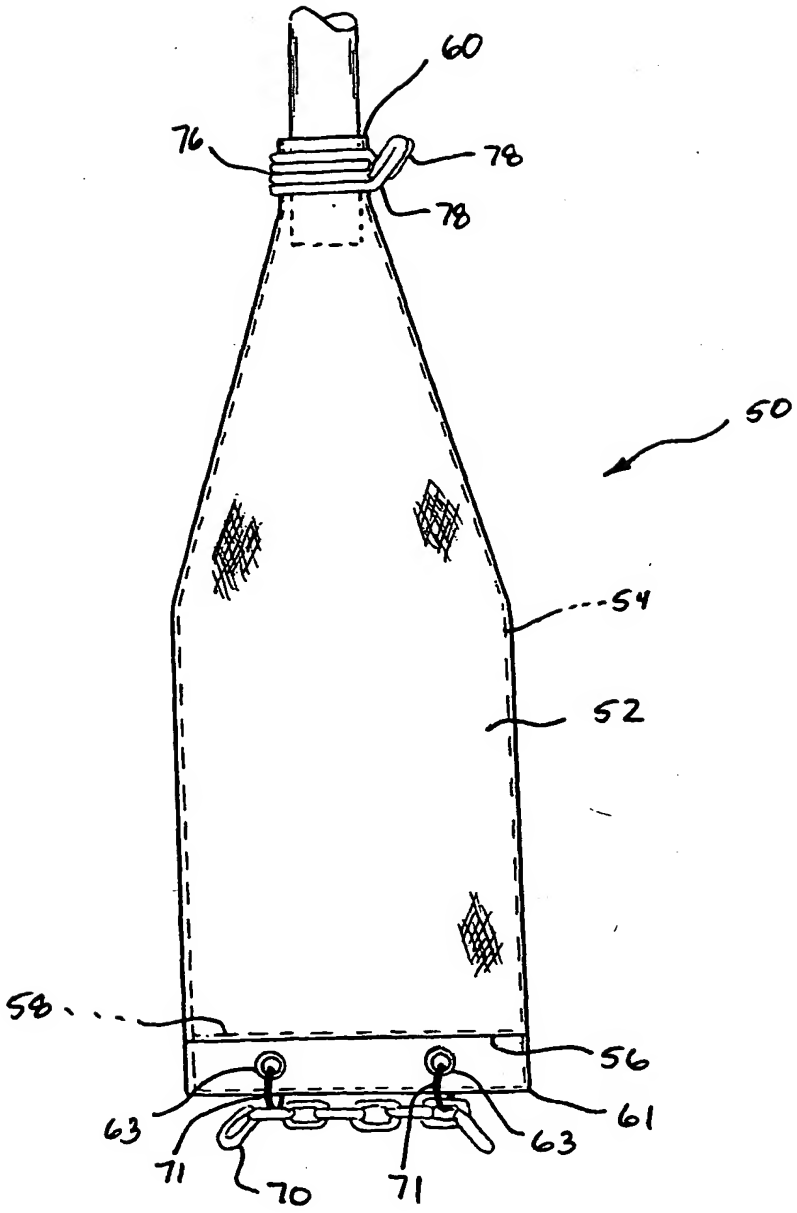
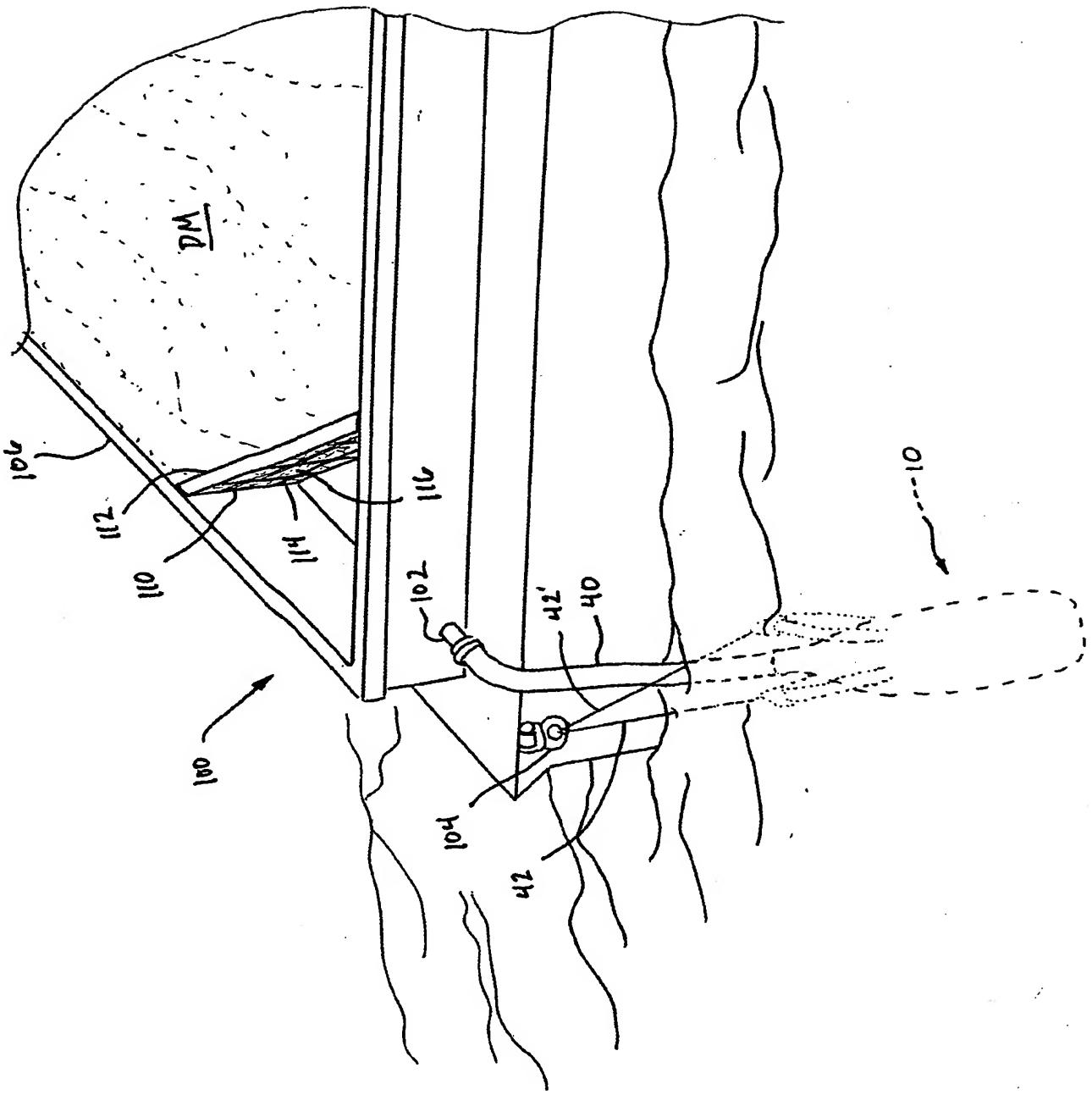


FIGURE 3

FIGURE 4



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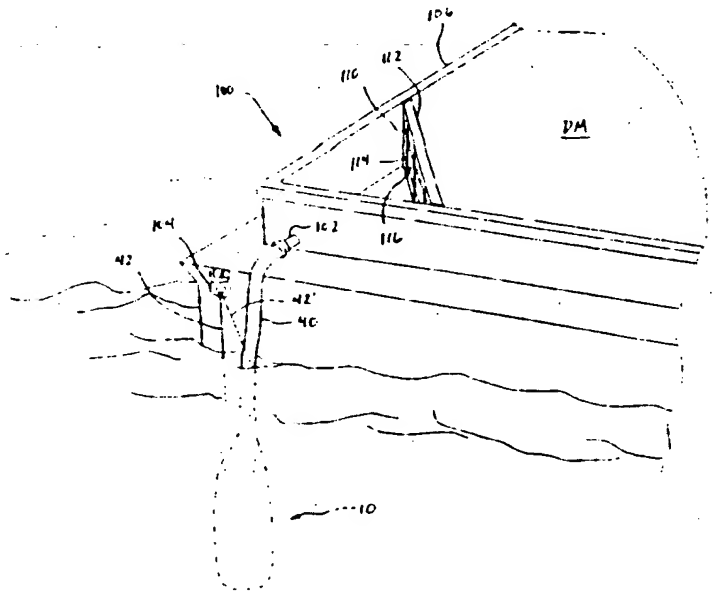
(54) Title: ATTACHMENT FOR USE WITH STOCKPILING BARGE AND METHOD OF FILTERING RUNOFF WATER THEREFROM



(57) Abstract: An attachment (10) to a drainage hose (40) for use on a stockpiling barge that includes: a fluid pervious bag (12) formed of a flexible fabric material, the fluid pervious bag having an open end and a closed end, a ballast material (30) attached to or retained within the closed end of the fluid pervious bag, and means (28) for securing the open end of the fluid pervious bag.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : B63J 4/00
US CL : 210/460
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 210/460, 237, 238, 317, 314, 316, 318, 242.1; 405/40, 41, 39; 114/26-38, 73

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,822,106 A (WILSON ET AL) 18 APRIL 1989 (18/4/1989), SEE ENTIRE DOCUMENT.	1, 2, 4, 5, 10-15, 18, AND 19
Y	US 5,089,108 A (SMALL) 18 FEBRUARY 1992 (18/2/1992), COL. 2, LINES 8-10.	1, 2, 4, 5, 10-15, 18, AND 19
Y	US 3,862,502 A (YOUNG) 28 JANUARY 1975 (28/1/1975), COL. 3, LINES 48-52.	3 AND 6
Y	US 3,762,562 A (OKUNIEWSKI T AL) 2 OCTOBER 1973 (2/10/1973), SEE FIGURE 1, 5, AND 7.	7 AND 8
Y	US 6,210,573 A (MARSHALL) 3 APRIL 2001 (3/4/2001), COL. 3, LINES 58-61.	9

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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